1. Introduction

The Opportunity Corridor Study proposes the construction of a new arterial roadway (boulevard) on a generally new alignment within the City of Cleveland, Cuyahoga County, Ohio. The purpose of this memorandum is to:

- Summarize previously completed analysis and recommendations associated with the West Alternates. This work was completed in Step 5 of the ODOT Project Development Process (PDP);
- Present analysis of the West Alternates completed in the early stages of Step 6; and
- Identify conclusions and recommendations based on the early Step 6 analysis.

2. Summary of Step 5 Analysis and Recommendations for West Alternates

The Opportunity Corridor study area is divided into three geographic sections (West, Central, and East). The West Section is located in the Saint Hyacinth neighborhood of Slavic Village and the Kinsman neighborhood between I-77 and E. 75th Street and includes the intersection of E. 55th Street and I-490. During Step 5 of the PDP, three alternates were developed and evaluated for the I-490/E. 55th Street intersection with the proposed Opportunity Corridor roadway, as described below. The schematics of the three west alternates studied during Step 5 are included with this memorandum for reference (See Appendix). These schematics include the proposed lane use as recommended from the Step 5 analysis.

- West Alternate A – Conventional four-legged, signalized intersection at I-490/E. 55th Street/Proposed Boulevard with nine lanes on I-490/Proposed Opportunity Corridor and seven lanes on E. 55th Street
- West Alternate B – Depress I-490 under E. 55th Street and braid a series of ramps west of E. 55th Street to provide access between the freeways and E. 55th Street
- West Alternate C – Depress I-490 under E. 55th Street and construct quadrant roadway in the vicinity of E. 59th Street to provide full access between E. 55th Street, the freeways, and the proposed boulevard

The analyses for each alternate are presented in the Opportunity Corridor Conceptual Alternatives Study (CAS) prepared in October 2010.

The West Alternates were presented to the public through a series of public and neighborhood meetings in October 2010. During these meetings, local residents indicated concerns regarding poor traffic operations, the large intersection size and pedestrian safety. Traffic operational concerns focused on the poor projected design year traffic operations at I-490/E. 55th Street/Proposed boulevard intersection (i.e., LOS

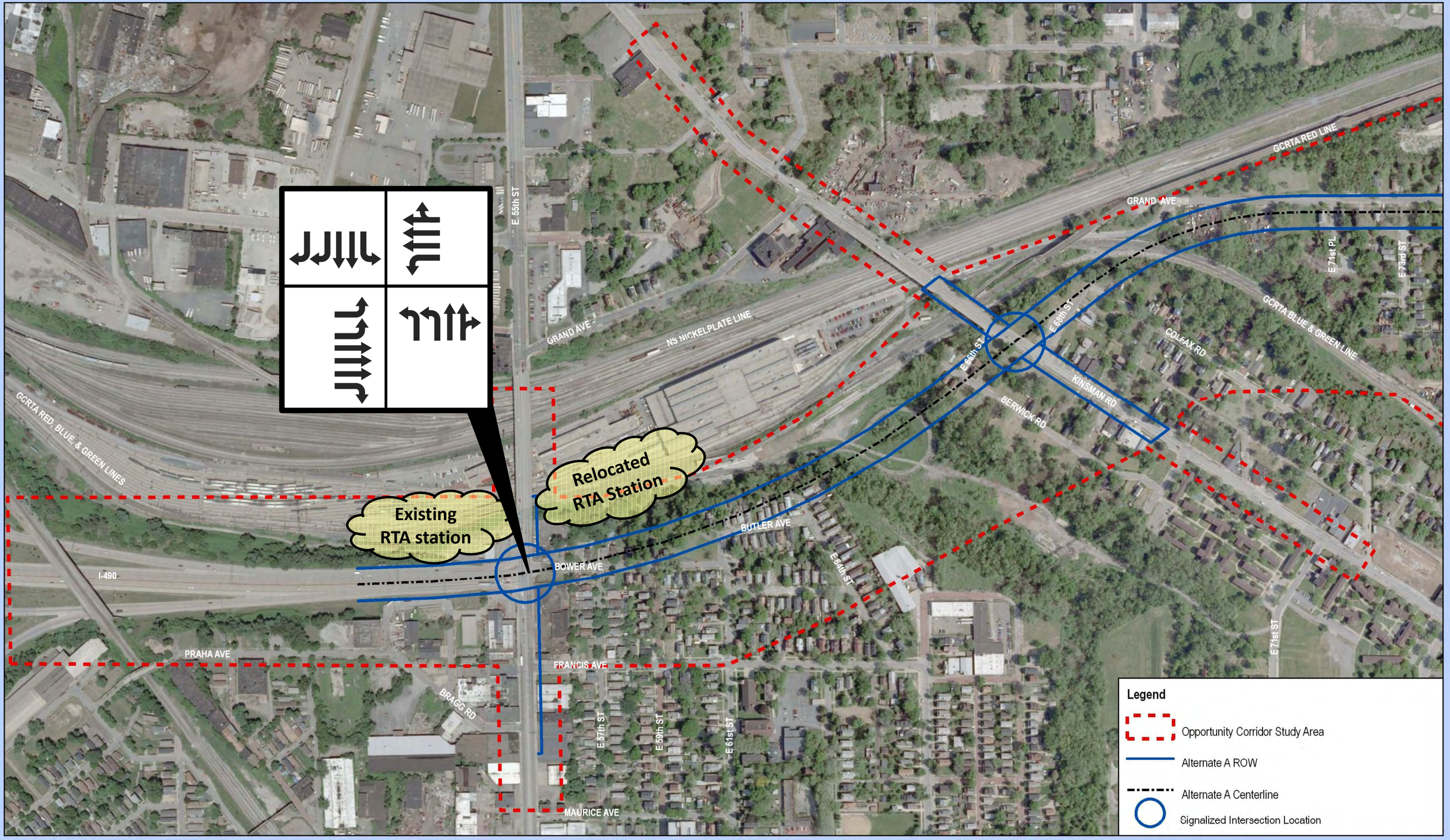
F). Residents also expressed concern that a green light condition at the intersection might discourage traffic exiting I-490 from slowing down when continuing east on the proposed boulevard.

Pedestrian safety concerns focused on safely crossing the large, high-volume intersection and access to the new Greater Cleveland Regional Transit Authority (GCRTA) station at E. 55th Street. The existing GCRTA train station is located west of E. 55th Street and north of I-490. GCRTA is currently reconstructing this station to include a head house on the east side of E. 55th Street. This will facilitate access to the station by eliminating the need for pedestrians to cross E. 55th Street and I-490. The updated station will also have platform access from both the east and west side of E. 55th Street. For West Alternate A, extending the proposed boulevard east of the existing I-490/E. 55th Street intersection would create greater separation between the Slavic Village neighborhood and the train station.

The CAS report (October 2010) and the public meeting presentations acknowledged the drawbacks of the at-grade intersection but also noted that this alternate provided the most conventional access to E. 55th Street. The at-grade intersection (West Alternate A) also had the lowest cost of the West section alternates and required fewer residential relocations than West Alternate C. It was recommended in the CAS report and at the public meetings that West Alternates A and C be further studied during Step 6 after Northeast Ohio Areawide Coordinating Agency (NOACA) provided updated and refined traffic projections for the project. The goal of the additional analysis was to determine if new traffic volumes would result in improved traffic operations and enhanced pedestrian safety through a smaller intersection footprint.

3. Step 6 – Early Analysis of West Alternates

On January 5, 2011, NOACA provided updated and refined corridor-wide traffic projections for use during Step 6 of the PDP. As a result, the traffic model was updated for West Alternates A & C. The updated model indicated that West Alternate A would need to retain the previously proposed 9-lane (I-490/Proposed Opportunity Corridor) by 7-lane (E. 55th Street) footprint to achieve Level of Service (LOS) E. However, even with this footprint, the E. 55th Street southbound to I-490 westbound right-turn lanes would not have an acceptable volume to capacity (v/c) ratio. To achieve a v/c ratio under 0.90, the generally accepted minimum operational standard, dual southbound right-turn lanes would be required. This would increase the proposed footprint of E. 55th Street to 8-lanes. Although the additional right-turn lane would enhance vehicular flow (i.e., improve from LOS E to LOS C), the increased footprint would further reduce pedestrian mobility and access. This, in turn, would further limit access to the RTA station and the surrounding neighborhoods. Figure 1 shows the refined lane use for West Alternate A.



CUY - Opportunity Corridor
(PID 77333)
Cleveland, OH

January 2011

Prepared by: LLS

Note:
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Aerial image is dated (circa 2005) and is shown only for illustrative purposes.

0 200 400 800 Feet

NORTH

Figure 1
Step 6 Refined Lane Use
West - Alternate A

HNTB

In contrast, the refined traffic analysis for West Alternate C indicated that the number of through lanes on the boulevard would be reduced from three to two. Figure 2 shows the refined lane use for West Alternate C. Even with the reduction in through lanes, all intersections associated with the proposed quadrant roadway would operate at LOS B. Additionally, separating the proposed boulevard and E. 55th Street would eliminate the need for pedestrians traveling on E. 55th Street to cross I-490 and the proposed boulevard to access surrounding neighborhoods and the GCRTA station.

Further study of the alignments and geometrics of the proposed West Alternates was also completed early in Step 6. A summary of these analyses is included below.

Existing Conditions

In the existing configuration, two I-77 ramps join I-490 eastbound lanes just west of E. 55th Street. The two I-77 ramps have an inside merge west of the entrance ramp nose. The existing conditions are shown below in Figure 3.

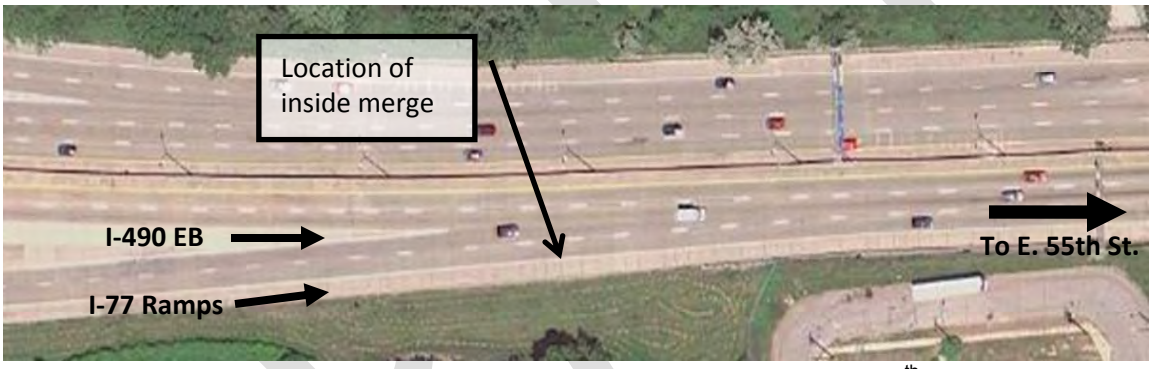
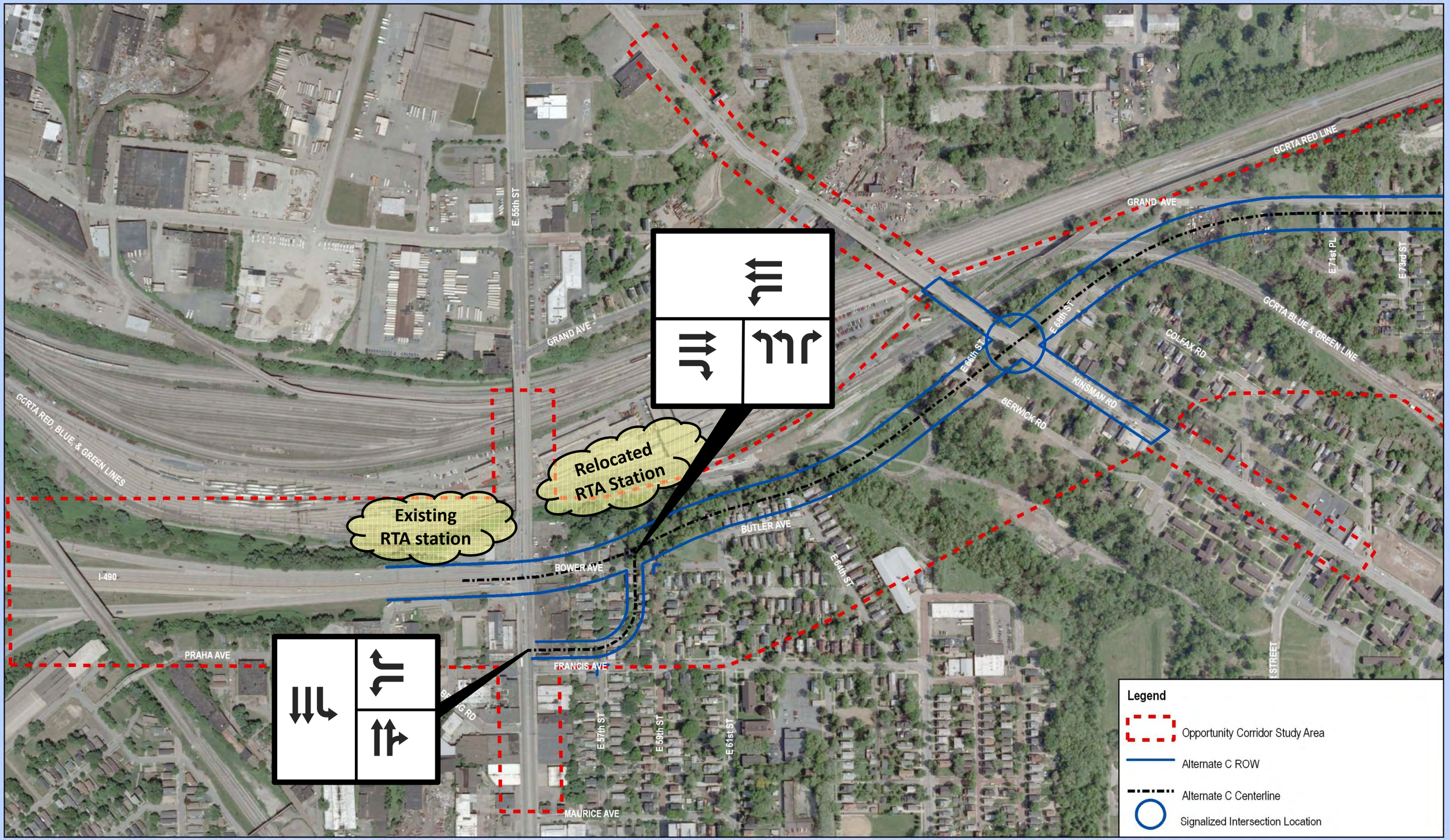


Figure 3 – I-77 ramps inside merge at I-490 eastbound located west of E. 55th Street

This configuration is not desirable from an operations and safety perspective and would need to be updated to meet current design standards. To address the ramp geometry, the two I-77 ramps would need to be reduced to a single lane prior to the entrance ramp nose. This modification would be required for both West Alternate A and West Alternate C.

In the existing configuration, the segment along I-490 between the I-77 ramps and E.55th Street operates as a weaving section. According to the American Association of State and Highway Transportation Officials (AASHTO) *A Policy Geometric Design of Highways and Streets* (2004), a weaving section is a highway segment where the pattern of traffic entering and leaving at contiguous points of access results in vehicle paths that cross each other. In this case, traffic traveling on the I-77 ramps and I-490 eastbound must cross each other in order to position for either northbound or southbound travel on E. 55th Street. Traffic movements within this weaving segment occur in a relatively short distance (approximately 775 feet between ramp nose and intersection stop bar) and create additional concerns from a safety and operations perspective.



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0 200 400 800 Feet

NORTH

Figure 2
Step 6 Refined Lane Use
West - Alternate C

HNTB

West Alternate A

The refined traffic analysis for West Alternate A indicates that approximately 650 feet of storage would be required for the turn lanes on I-490 eastbound at the E. 55th Street intersection.

According to ODOT's L&D Manual, Volume 1, Figure 505-1aE (Attached – See Appendix), the distance required to merge the two I-77 ramps is 400 feet for a low speed ramp. To properly align the entrance ramp nose as shown in Figure 503-4aE (Attached – See Appendix), approximately 200 feet of additional distance is required for taper and curvature. Per Figure 503-4aE, an additional 700 feet are required to allow traffic from I-77 to accelerate and merge with I-490 eastbound traffic. Thus, the total distance required to address the inside merge condition is approximately 1,300 feet. However, the total available distance is only 1,000 feet (See Figures 4A and 4B). Given these constraints, the distance required to merge the lanes would need to be reduced by approximately 300 feet or the left-turn lane storage on I-490 eastbound at its intersection with E. 55th Street would need to be cut in half. Both of these options would compromise traffic operations.

As part of West Alternate A, the weave section that currently exists along I-490 between the I-77 ramps and E. 55th Street would remain in-place. Additional distance would need to be provided to accommodate the weaving movements within this section of roadway. The modifications proposed with West Alternate A would further compromise safety and traffic operations by requiring weaving traffic to cross additional lanes. For example, traffic destined to travel north on E. 55th Street must cross at least three lanes of traffic within a relatively short distance.

In order to eliminate the inside merge, provide the necessary distance to safely and efficiently complete the merging and weaving movements, and to provide the required storage capacity for the turn lanes at E. 55th Street, it would be necessary to completely re-design and reconstruct at least portions of the I-77/I-490 interchange. This would require reconstruction of the Norfolk Southern railroad bridge, realignment of the freeways and interchange ramps, as well as other large structures associated with the existing four-level interchange. The potential costs associated with this work would be substantial.

West Alternate C

The refined traffic analysis for West Alternate C indicates that approximately 625 feet of storage is required for storage and deceleration of I-490 eastbound traffic wishing to turn right onto the proposed quadrant roadway east of E. 55th Street.

NS RAILROAD

I-77 SB EXIT RAMP

I-77 NB EXIT RAMP

PRAHA AVENUE

I-490

POB 10+00.00

10+00

S 87°24'14" E

478.36'

PCM 14+78.36

15+00

R =5729.58'
Delta =4°50'11"
L =483.65'
T =241.97'
C =483.50'
CH =S 89°49'20" E

PTM 19+62.00

20+00

N 87°45'34" E

858.36'

MATCHLINE STA. 22+00

21+00 END TURN LANES AT GRADE ALT.

400' PER FIGURE 505-1AE TO MERGE I-77 EXIT RAMPS TO ONE LANE

200'±
TAPER AND CURVE/SPIRAL TO ALIGN PER FIGURE 503-4AE

700' ACCEL/MERGE PER FIGURE 503-4AE (TOTAL REQUIRED DISTANCE = 1300'±)

TOTAL AVAILABLE DISTANCE TO COMPLETE MERGE= 1000'±

TOTAL AVAILABLE DISTANCE < REQUIRED

** LANES CANNOT BE SUCCESSFULLY MERGED AT LOW SPEED CONDITION

HORIZONTAL SCALE IN FEET
0 25 50 100

CALCULATED

CHECKED

OPPORTUNITY CORRIDOR-WEST ALTERNATE A
LOW SPEED MERGE DETAIL & INTERSECTION CONFIGURATION

FIGURE 4A
03/03/11

7

\\clew001\prmwork\JOBS\39853\TECHPROD\rwy\Step6\Plan sheets\MTR-at grade_low speed_merge.dgn 03-MAR-2011 10:24 AM mregan

I-490

PRAHA AVENUE

PT 19+62.00

20+00

25+00

30+00

700' ACCEL/MERGE PER FIG. 503-4AE
(TOTAL REQUIRED DISTANCE= 1300'±)

650' THRU MOVEMENT STORAGE

Sta. 28+90.73 ℄ O.C. BLVD.
= Sta. 5+35.94 ℄ E55TH ST.

EXISTING RTA STATION

RELOCATED RTA STATION

E 55TH STREET

PROP. BOULEVARD

PT 36+82.24

HORIZONTAL SCALE IN FEET
0 25 50 100

CALCULATED MTR
CHECKED

OPPORTUNITY CORRIDOR-WEST ALTERNATE A
LOW SPEED MERGE DETAIL & INTERSECTION CONFIGURATION

FIGURE-4B
03/03/11

8

\\dlew00\pmwork\JOBS\39853\TECHPROD\hwy\Step6\Plan sheets\MTR-at grade2.dgn 03-MAR-2011 10:27AM mregan

According to ODOT's L&D Manual, Volume 1, Figure 505-1aE (Attached – See Appendix), the distance required to merge the two I-77 ramps is 400 feet for a low speed ramp. To properly align the entrance ramp nose as shown in Figure 503-4aE (Attached – See Appendix), approximately 200 feet of additional distance is required for taper and curvature. Per Figure 503-4aE, an additional 700 feet are required to allow traffic from I-77 to accelerate and merge with I-490 eastbound traffic. Thus, the total distance required to address the inside merge condition is approximately 1,300 feet. Based on the geometrics of the design, approximately 1,350 feet are available (See Figure 5). Therefore, West Alternate C would address the inside merge condition without the need for any re-design or reconstruction of the existing I-77/I-490 interchange. This would improve operations and safety while still providing the required storage and deceleration at the intersection of the proposed boulevard and quadrant roadway.

West Alternate C would include the construction of a quadrant roadway in the southeast quadrant of the I-490/E. 55th Street/Proposed Boulevard intersection. The proposed quadrant roadway would eliminate the existing weave along I-490 between the I-77 ramps and E. 55th Street. Additional geometric studies would be completed as part of Step 6 to optimize the configuration and spacing of the required merge associated with the I-77 ramps and development of the right-turn lane at the proposed quadrant roadway.

4. Conclusions and Recommendations

The results of the analyses completed in the early stages of Step 6 indicate that the configuration of the at-grade intersection proposed with West Alternate A would not be geometrically feasible without incurring extreme costs to re-design and reconstruct the I-77/I-490 interchange. West Alternate A would also leave the existing weave section along I-490 between the I-77 ramps and E. 55th Street in-place. The weave section would further compromise safety and traffic operations by requiring weaving traffic to cross at least three lanes of traffic within a relatively short distance prior to the intersection with E. 55th Street. Furthermore, the large intersection area and high traffic volumes would negatively affect pedestrian safety and mobility, including access to the GCRTA station. Residents also expressed concerns regarding the safe transition from higher speed interstate travel on I-77 and I-490 to lower speeds more suitable for the proposed urban boulevard and the residential neighborhoods in the study area. For these reasons, it is recommended that West Alternate A be eliminated from additional study.

West Alternate C, on the other hand, would address the inside merge condition without the need for re-design or reconstruction of the interchange. Consequently, West Alternate C is recommended for continued analysis in Step 6.

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10	FIGURE 5 03/03/11	OPPORTUNITY CORRIDOR-WEST ALTERNATE C LOW SPEED MERGE DETAIL & INTERSECTION CONFIGURATION	CALCULATED MTR CHECKED ___	0 50 25 100 HORIZONTAL SCALE IN FEET

Appendix

Conceptual Alternatives Study (October 2010) – Lane Use West Alternate A

Conceptual Alternatives Study (October 2010) – Lane Use West Alternate B

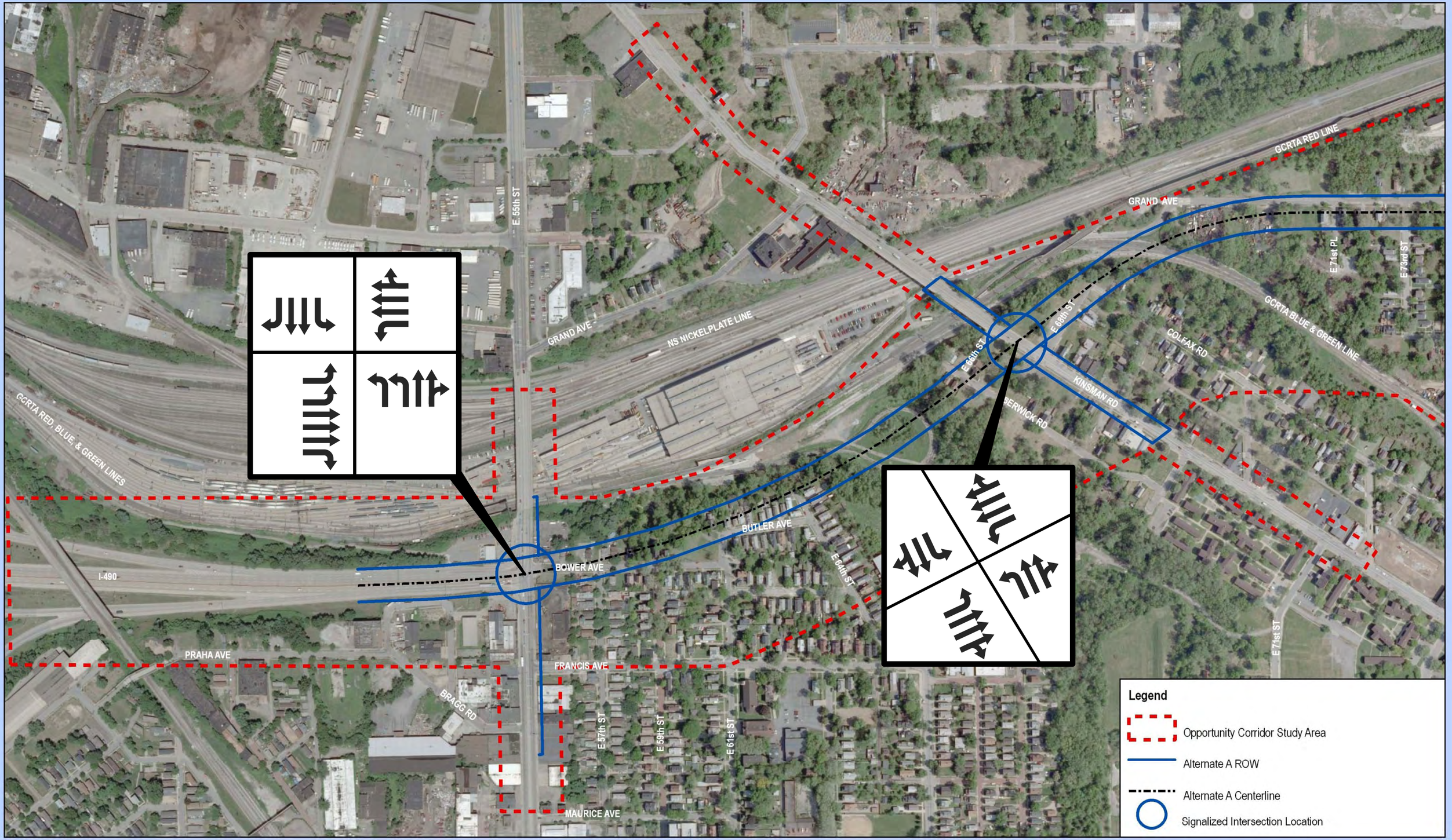
Conceptual Alternatives Study (October 2010) – Lane Use West Alternate C

ODOT L&D Manual, Volume 1, Figure 503-4aE

ODOT L&D Manual, Volume 1, Figure 505-1aE

Conceptual Alternatives Study (Oct. 2010)

Lane Use for West Alternates A, B, and C



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0 200 400 800 Feet

NORTH

Figure 3-1a
Lane Use
West - Alternate A

E. 55th ST
GRAND AVE
NS NICKELPLATE LINE
GCRTA RED LINE
GRAND AVE
E 71st PL
E 73rd ST
GCRTA BLUE & GREEN LINE
COLFAX RD
E 66th ST
E 68th ST
KINSMAN RD
BERWICK RD
GCRTA RED, BLUE, & GREEN LINES
BUTLER AVE
E 64th ST
I-490
BOWER AVE
PRAHA AVE
FRANCIS AVE
BRAGG RD
E 57th ST
MAURICE AVE
ST STREET

Legend

- Opportunity Corridor Study Area
- Alternate B ROW
- Alternate B Centerline
- Signalized Intersection Location

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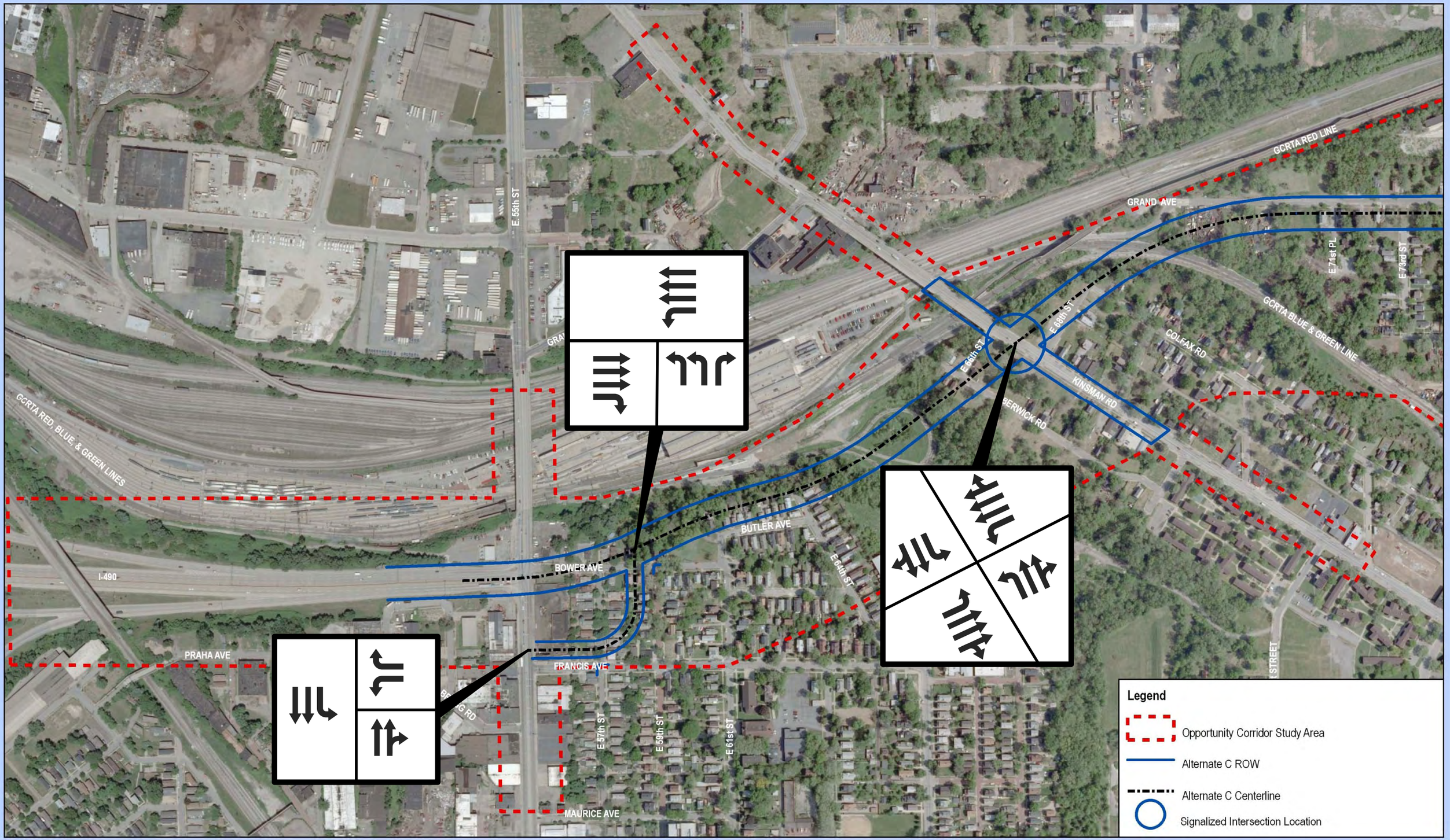
0 200 400 800 Feet

NORTH

Figure 3-1b
Lane Use
West - Alternate B



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0 200 400 800 Feet

NORTH

Figure 3-1c
Lane Use
West - Alternate C

ODOT Location & Design Manual – Section 500 Interchange Design Details

Figure 503-4aE and Figure 505-1aE

LOW-SPEED ENTRANCE TERMINALS

503-4aE

REFERENCE SECTIONS
503.6.2

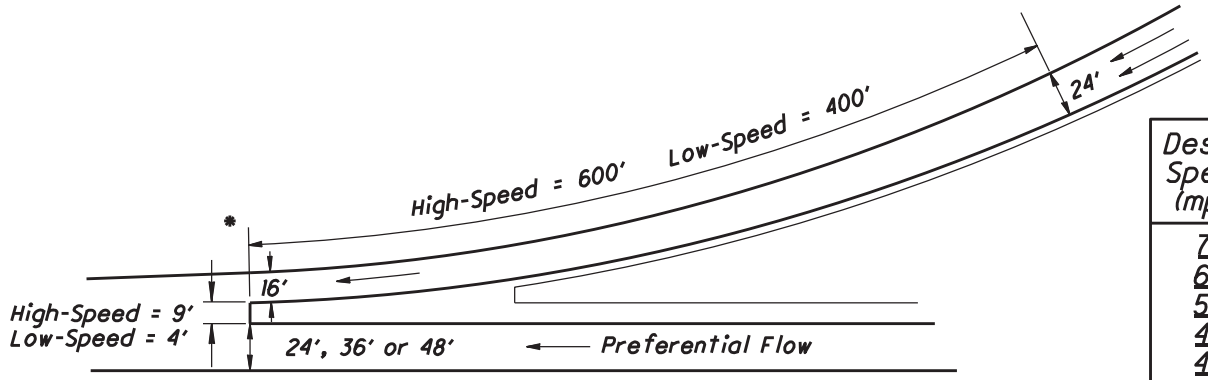
LOW-SPEED ENTRANCE TERMINALS

For Notes, see adjacent sheet.

MULTI-LANE ENTRANCE RAMPS AND CONVERGING ROADWAYS

505-1aE

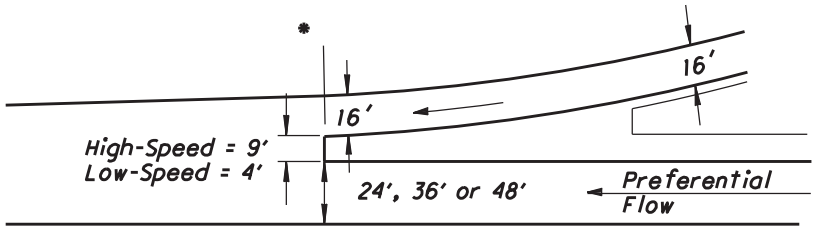
REFERENCE SECTIONS 505.1



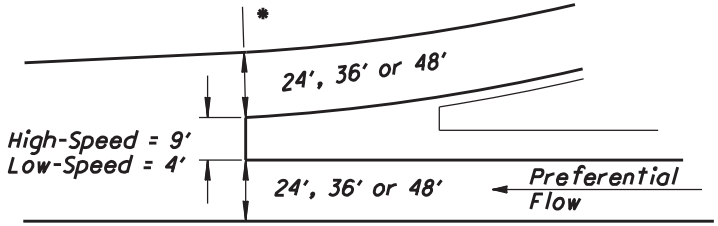
TWO-LANE ROADWAY REDUCED TO SINGLE LANE PRIOR TO ENTRANCE NOSE

TABLE A

Design Speed (mph)	Taper Rate	
	High-Speed	Low-Speed
70	50:1	---
60	50:1	---
50	50:1	---
45	---	35:1
40	---	35:1
30	---	35:1

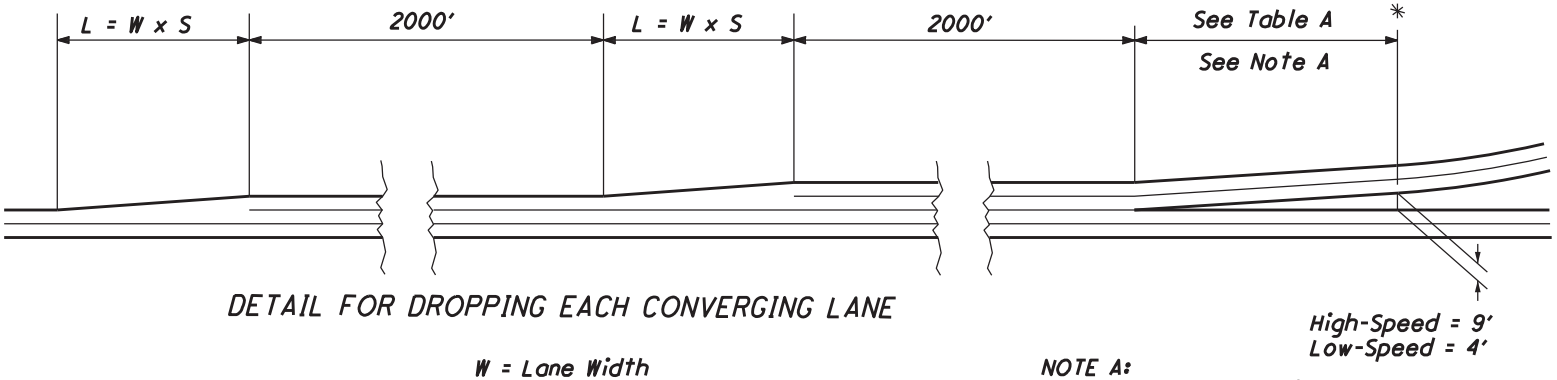


SINGLE LANE CONVERGING WITH MULTI-LANE



MULTI-LANE CONVERGING WITH MULTI-LANE

* Note: the number of lanes leaving the entrance nose must be equal to the total number of lanes (converging plus mainliine) approaching the entrance nose.



DETAIL FOR DROPPING EACH CONVERGING LANE

W = Lane Width
S = Design Speed

NOTE A:
Vertical alignment of both the mainline and the ramp should provide Decision Sight Distance, Avoidance Maneuver C or E, as per Figure 201-6.